MODIS Cloud Mask and Extension to a MODIS/VIIRS Cloud Mask

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MODIS-VIIRS Cloud Mask (MVCM)

- MVCM "philosophy" same as for MODIS cloud mask (MOD35)
- MVCM ingests similar L1b bands for VIIRS and MODIS processing (spectral radiance data)
- MVCM contains similar output as MODIS (48 bits/pixel)
- MVCM output contains confidence of clear sky (Q) values
- Algorithm same as MODIS (MOD35) where possible
- Ancillary data similar to MODIS (GDAS, SSTs, LST, etc.)
- Some improvements made over MODIS Collection 6

MVCM Algorithm

Similar to MODIS cloud mask (MOD35)

Improvements on MODIS Collection 6 cloud mask

- Solar and viewing zenith angle corrections to 0.86 μm day ocean cloud test thresholds
- Viewing zenith angle corrections to 0.65 μm day land cloud test thresholds
- Surface snow detection improvements in taiga and montane environments

Deficiencies from MODIS cloud mask due to fewer spectral bands

- Polar night deep inversion/clear sky detection
- Polar night cloud detection
- Sun-glint clear/cloudy sky discrimination
- Ocean night clear/cloudy sky detection (minor impact)

January 2013	MYD35 vs. CALIOP				MVCM Aqua vs. CALIOP				MVCM NPP vs. CALIOP (5 minute filter)			
Scene Type	HR Cloud	HR Clear	HR Comb	H-K SS	HR Cloud	HR Clear	HR Comb	H-K SS	HR Cloud	HR Clear	HR Comb	H-K SS
Global	87.8	87.8	87.8	75.6	86.9	85.9	86.5	72.7	87.4	82.5	85.8	69.9
60N-60S	92.0	85.1	89.9	77.1	91.5	84.6	89.4	76.1	91.4	82.1	88.4	73.5
Global Day	91.1	88.7	90.3	79.8	91.4	87.1	89.9	78.5	89.8	85.3	88.2	75.1
60S-60N Day	92.6	86.4	90.5	79.8	93.2	84.8	90.3	78.0	92.8	82.4	89.2	75.2
Global Night	84.8	86.8	85.4	71.6	82.7	84.5	83.3	67.2	85.3	79.4	83.4	64.7
Water Nt	87.6	86.3	87.2	73.9	87.4	86.4	87.1	73.8	88.1	81.6	86.4	69.7
60S-60N Water Nt	93.2	82.8	90.8	76.0	92.9	84.0	90.8	76.9	91.4	81.7	89.1	73.1
Global Land	79.5	88.8	83.7	68.2	74.0	87.9	80.4	61.9	77.0	83.5	79.8	60.5
Global Land Day	81.9	89.6	85.7	71.5	78.8	92.4	85.5	71.2	76.8	89.4	82.6	66.2
60S-60N Land Day	87.9	83.1	85.8	71.0	83.8	89.3	86.2	73.1	85.7	81.5	84.0	67.2
Global Land Nt	77.1	87.6	81.4	64.7	69.2	81.7	74.4	50.9	77.3	76.0	76.8	53.4
60S-60N Land Nt	85.6	84.2	85.1	69.8	79.8	84.9	81.8	64.7	85.9	81.9	84.3	67.8
Polar	77.1	92.6	83.2	69.6	75.1	88.1	80.2	63.2	78.3	83.1	80.0	61.4
Polar Day	86.7	93.8	89.5	80.5	86.4	92.1	88.7	78.5	82.5	92.0	86.0	74.5
Polar Nt	69.2	91.6	78.0	60.8	65.8	84.8	73.3	50.6	74.8	75.9	75.2	50.7
Arctic Nt	63.2	92.3	75.9	55.5	58.0	89.4	71.7	47.4	67.7	82.8	73.9	50.5
Antarctic Day	86.2	94.9	89.7	81.1	87.3	92.3	89.3	79.5	83.3	94.3	87.3	77.7
Desert Day	81.7	86.8	84.5	68.5	79.7	88.4	84.8	68.1	82.4	84.8	83.7	67.2
Desert Nt	78.4	86.3	82.5	64.5	73.4	85.4	79.8	58.9	81.1	84.9	83.1	66.0

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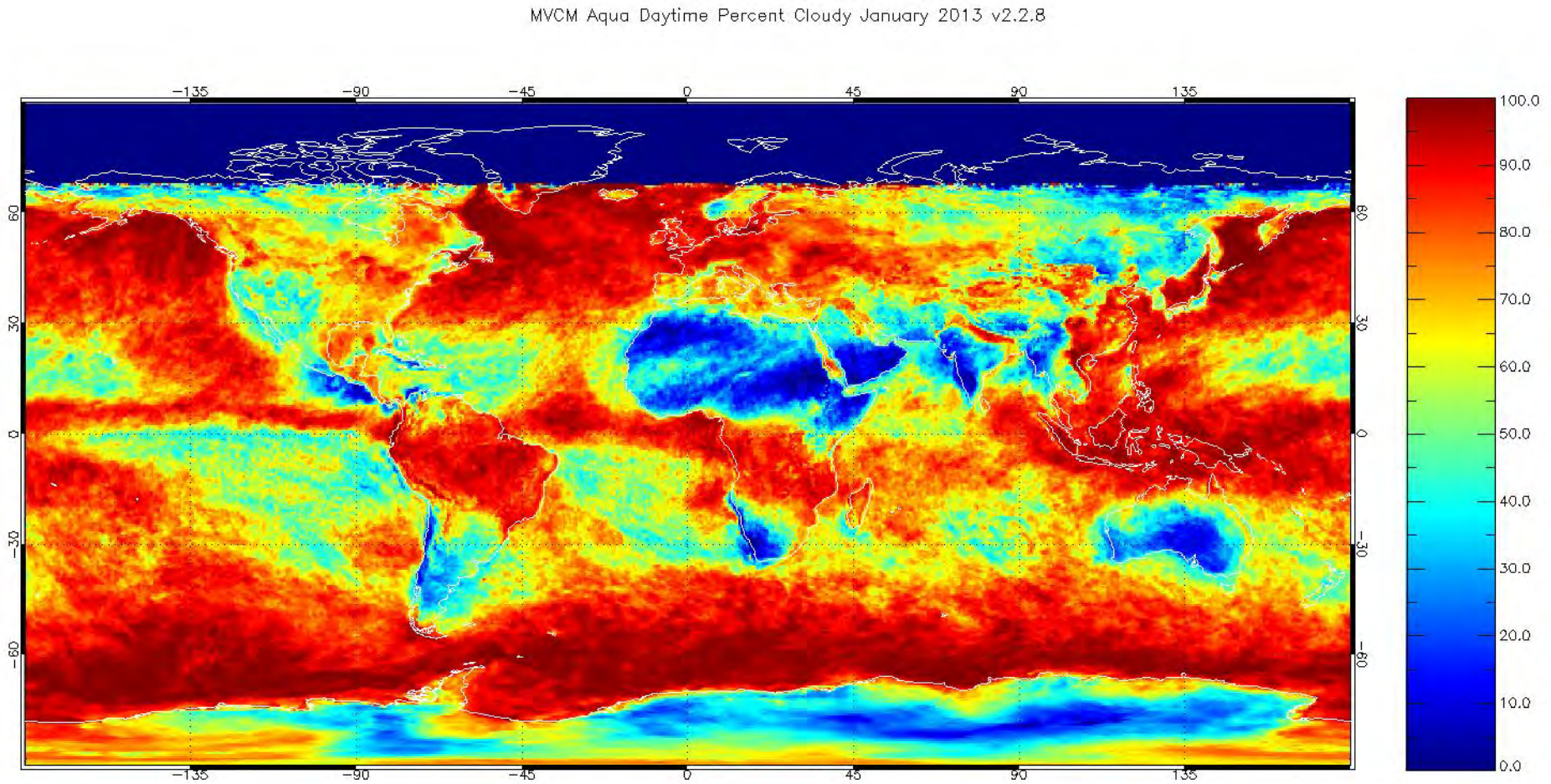
MVCM Aqua Daytime Percent Cloudy, January 2013



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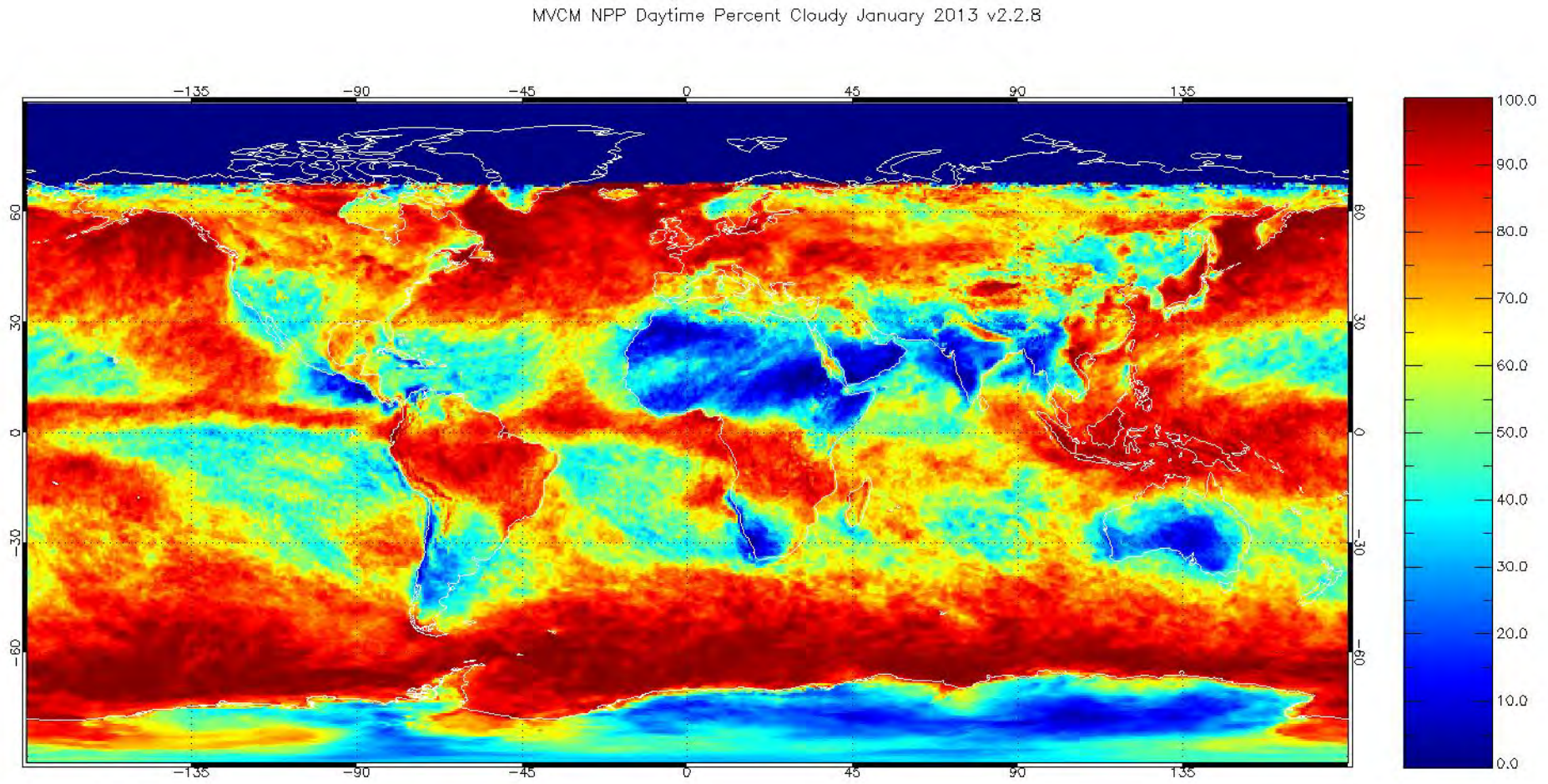
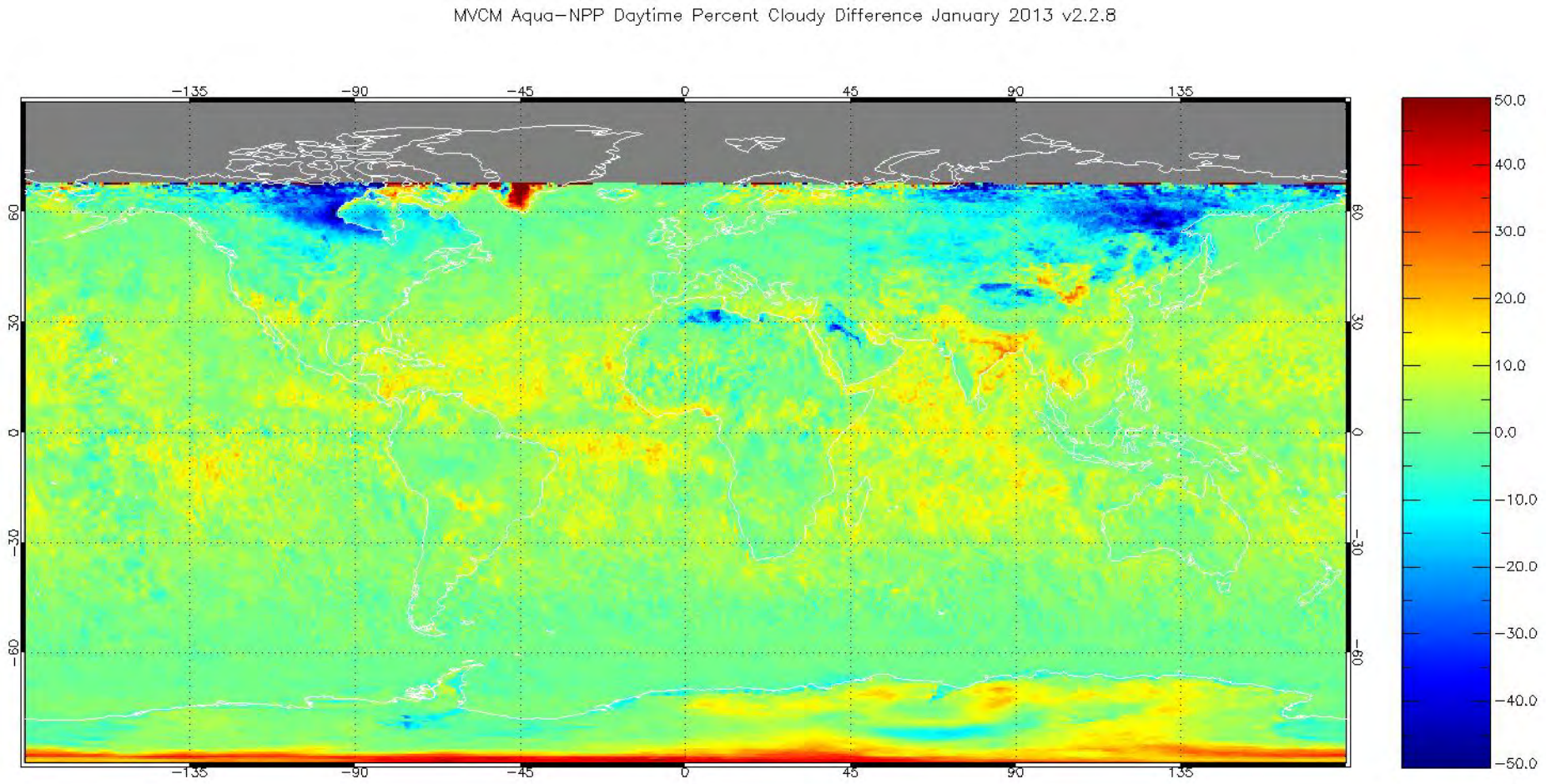
MVCM NPP Daytime Percent Cloudy, January 2013



MVCM Aqua – NPP Daytime Percent Cloudy, Difference January 2013



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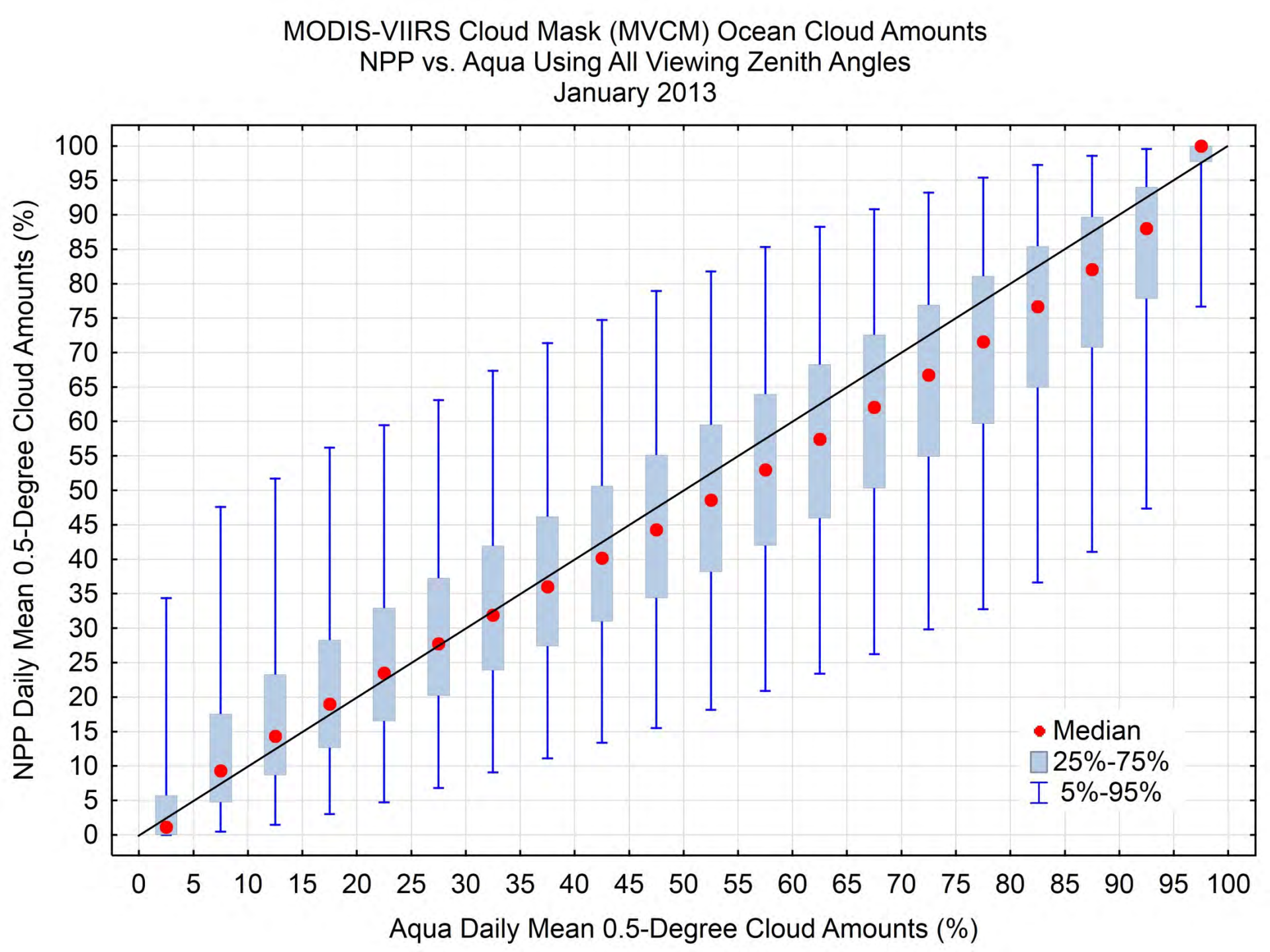
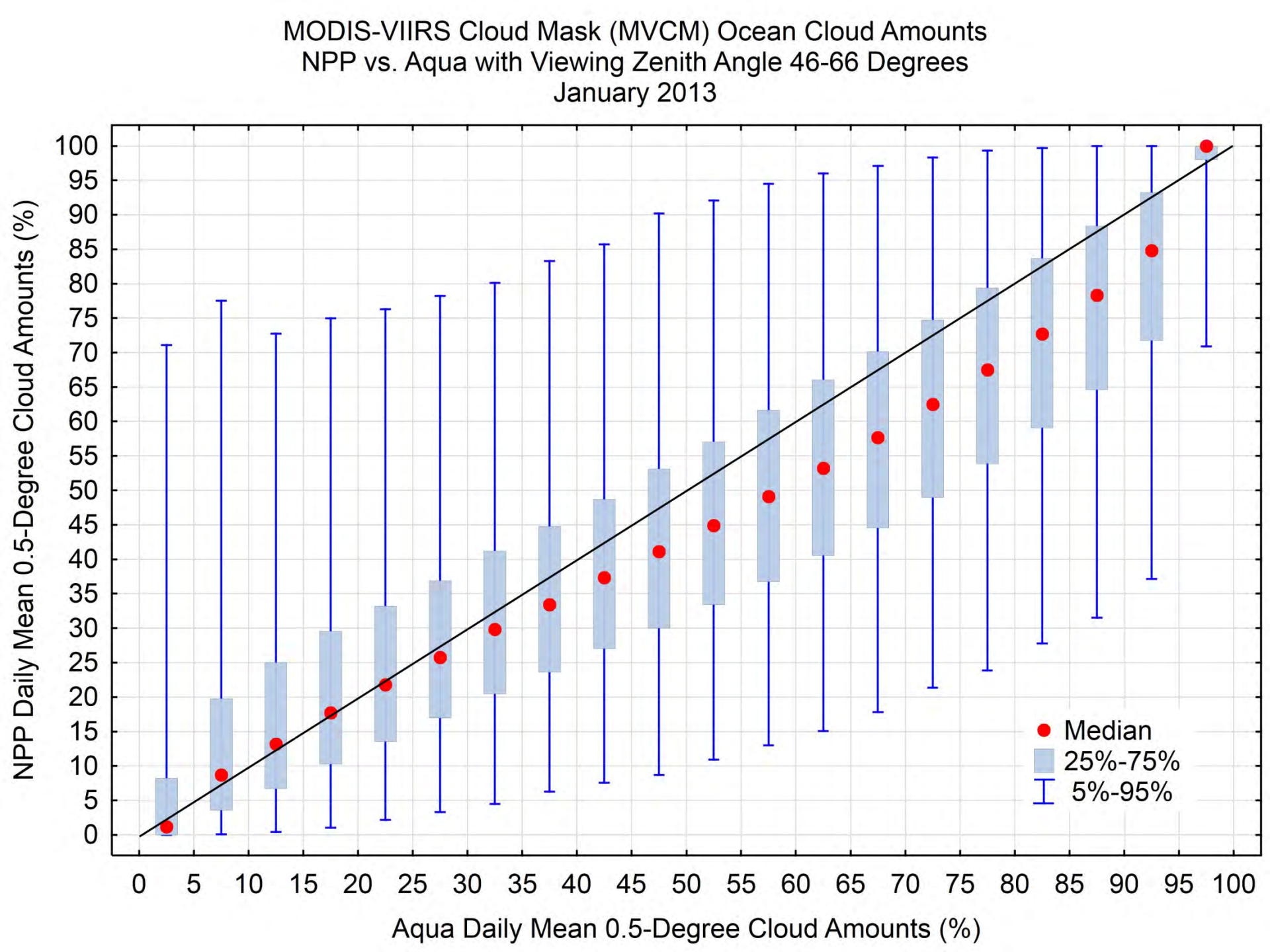
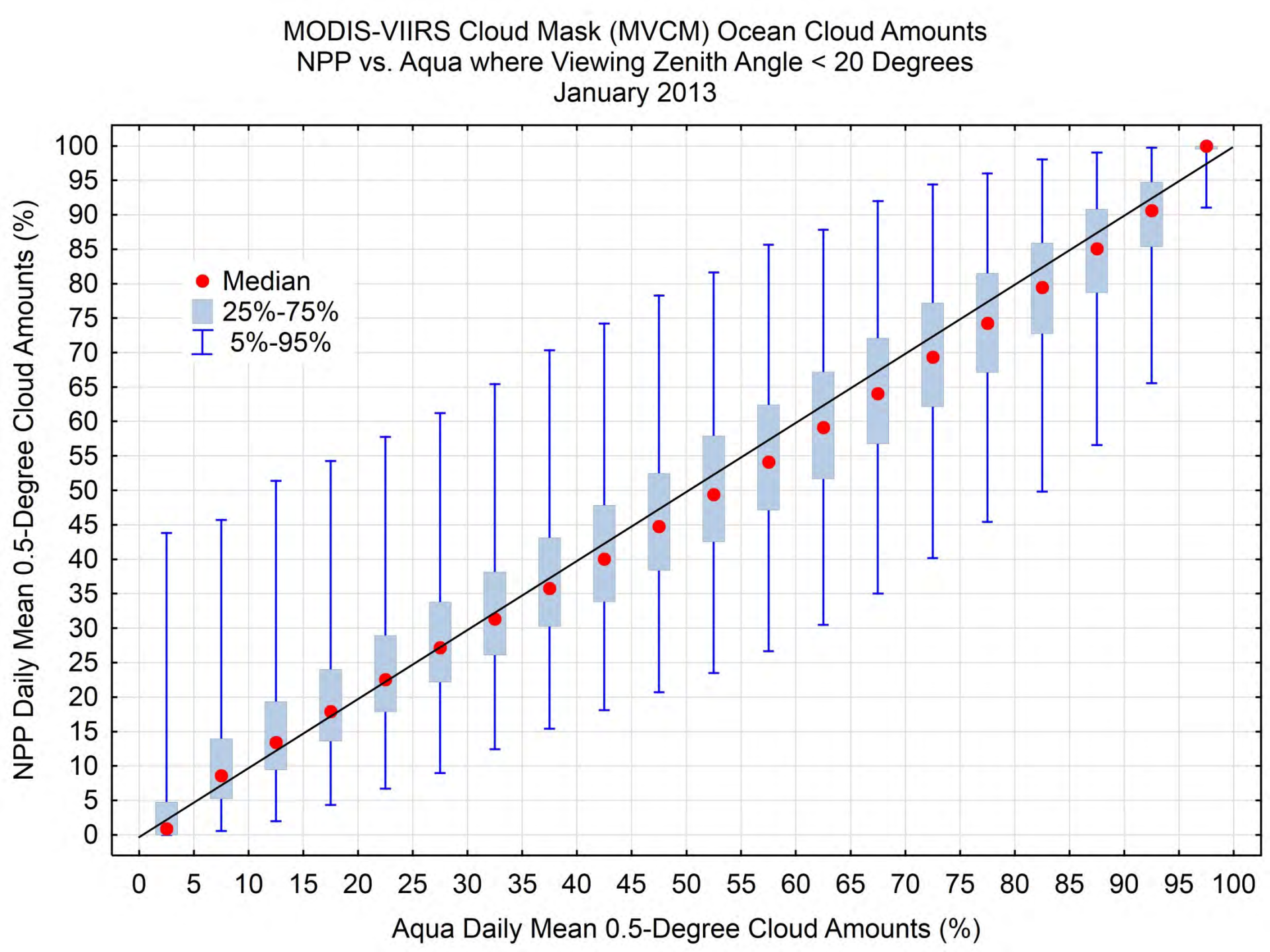
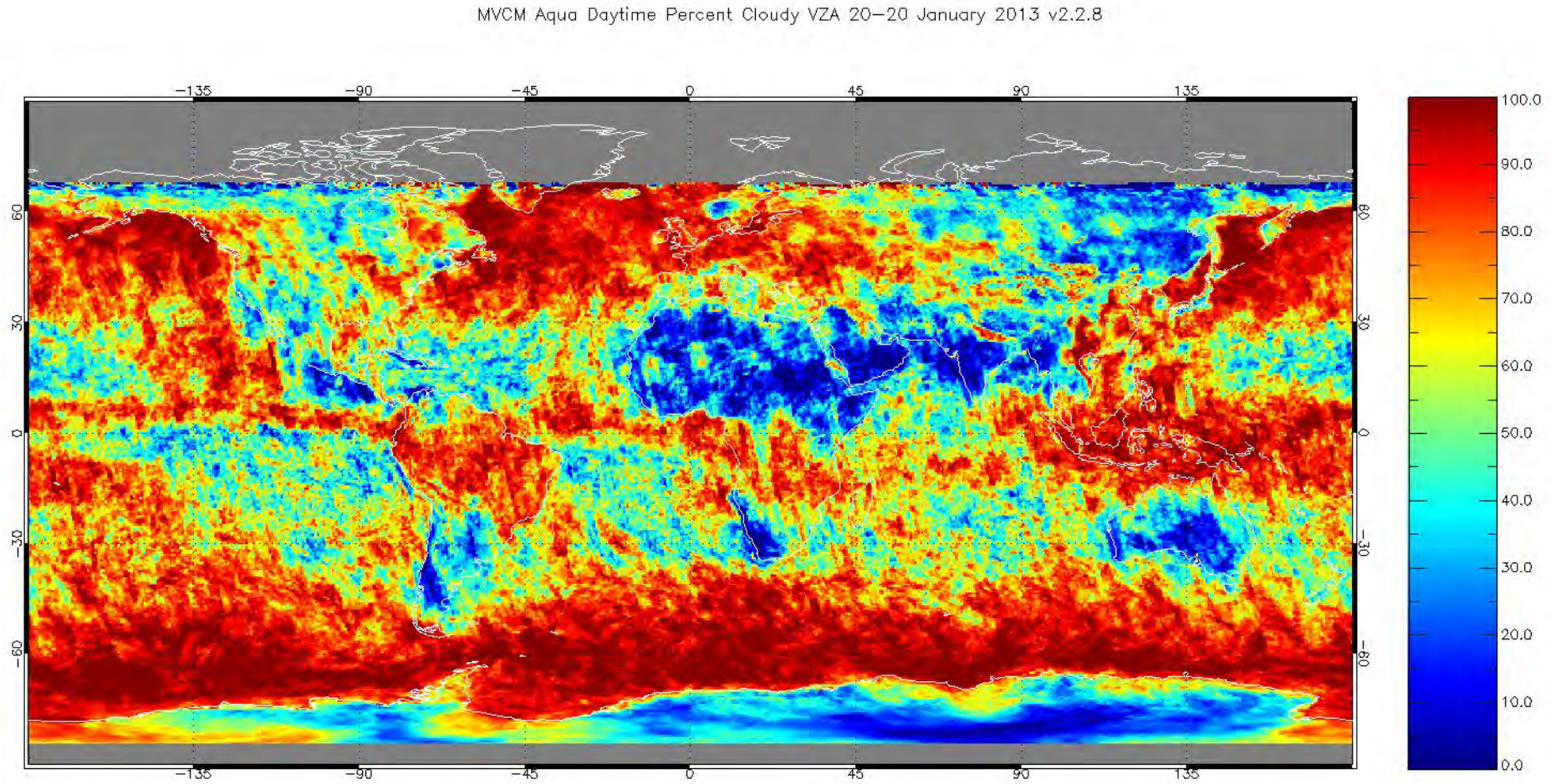

MODIS-VIIRS Cloud Mask (MVCM) Ocean Cloud Amounts
NPP vs. Aqua Using All Viewing Zenith Angles
January 2013
NPP Daily Mean 0.5-Degree Cloud Amounts (%)
Aqua Daily Mean 0.5-Degree Cloud Amounts (%)
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
Median
25%-75%
5%-95%

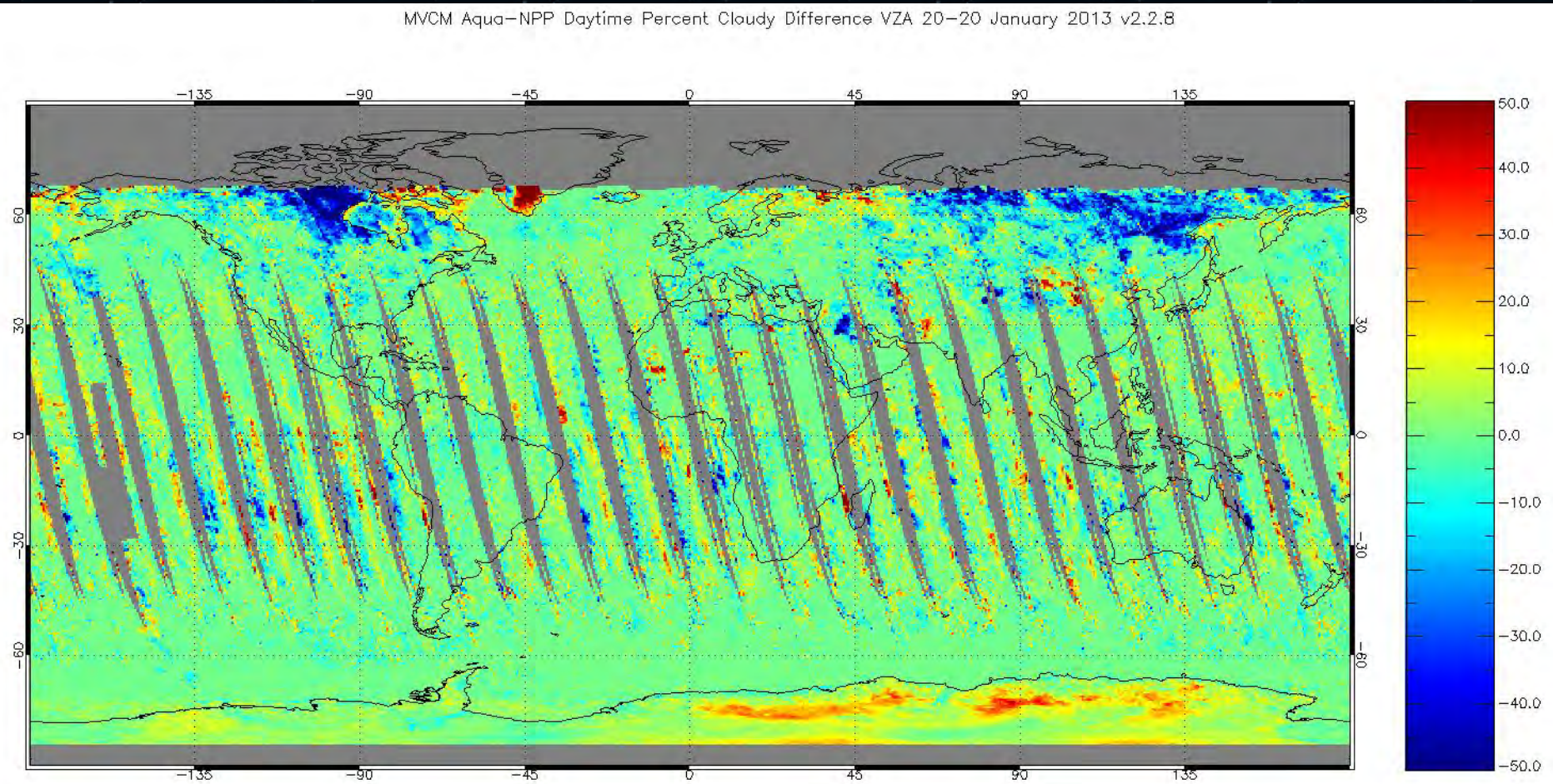

MODIS-VIIRS Cloud Mask (MVCM) Ocean Cloud Amounts
NPP vs. Aqua with Viewing Zenith Angle 46-66 Degrees
January 2013
NPP Daily Mean 0.5-Degree Cloud Amounts (%)
Aqua Daily Mean 0.5-Degree Cloud Amounts (%)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Median
25%-75%
5%-95%


MODIS-VIIRS Cloud Mask (MVCM) Ocean Cloud Amounts
NPP vs. Aqua where Viewing Zenith Angle < 20 Degrees
January 2013
Median
25%-75%
5%-95%
NPP Daily Mean 0.5-Degree Cloud Amounts (%)
Aqua Daily Mean 0.5-Degree Cloud Amounts (%)
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100

MVCM Aqua Daytime Percent Cloudy, January 2013 (VZA <= 20 degrees)



MVCM Aqua – VIIRS Daytime Percent Cloudy, January 2013 (VZA <= 20 degrees)



Summary

The MVCM is a “work in progress”. (See Poster of R. Frey)

Agreement between CALIOP and MVCM Aqua, and between CALIOP and MVCM NPP is reasonable and approaches that between CALIOP and MYD35 (Aqua MODIS cloud mask).

Agreement between MVCM Aqua and MVCM NPP is also reasonable. Refinements in NPP cloud detection thresholds under way for polar and snow covered regions.

Differences in monthly values due to instrument differences in fov and scanning.

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